SUPPLEMENTARY DATA

Control analyses

Effects of Drug Manipulations on Mood. As reported in (Chelnokova et al., 2014), repeated-measures ANOVA test was employed to evaluate the effect of the MOR manipulations on mood using the factors Drug (morphine, placebo, naltrexone), Mood Type (happy, anxious, irritated, feeling good), and Time (before drug administration, 60 min after ingestion, ~100 min after ingestion, and after completion of all tasks). Neither morphine, nor naltrexone treatment significantly affected mood (Drug main effects/interactions: all *F*s≤1.29, *p*s≥0.22; means and SDs for pre-drug baseline ratings, and for the change from baseline for each of the four mood types are reported in Table S1).

Effects of Drug Manipulations on Motor Coordination. A motor coordination task (Giovannoni et al., 1999) was administered at ~100 minutes after drug ingestion. In this test, participants were asked to use their dominant index finger to alternate between two keyboard keys, 15 cm apart, as quickly and accurately as possible. The dysmetria score (DS) is a weighted score of number of incorrect presses corrected for speed. A repeated-measures ANOVA of the Dysmetria x Drug showed no significant effect of drug: $F\ (_{2,\ 58}) = 0.91$, $p = 0.38$, $\eta_p^2 = 0.03)$. Therefore, the observed differences in fixations to the face and eyes reported after morphine and naltrexone treatment are unlikely to result from drug effects on motor or eye-hand coordination.

Effects of Drug Manipulations on Eye Movements. Previous research on psychomotor, oculomotor, and cognitive effects of acute opioid agonist administration has produced variable results (for a review, see Zacny, 1995). Most studies that have reported changes to eye movements (dynamic visual acuity; Bradley and Nicholson, 1986; disturbances of eye fixations; Rottach et al., 2002; saccadic movement properties; Melichar et al., 2003) have employed other drugs (codeine, pethidine and fentanyl, and hydromorphone respectively) and larger doses than the 10 mg morphine

used here. Note that opioid dose conversion is based on their equivalent analgesic effects (Tørisen, 2003); equivalent doses for sedation and putative related motor and cognitive effects are not well established (Fitzgibbon, 2007). In one study employing methadone doses with comparable or somewhat higher analgesic effects to the morphine dose in the current study, Rothenberg et al. (1980) reported no effects on saccade velocity, but a significant increase in saccade overshoot to target locations greater than 10-15° of visual angle (VA) away (in the horizontal direction) from the initial, central fixation point. Therefore, even if similar effects of opioid agonist treatment were present in the current study, it is unlikely that they would have affected gaze patterns to the facial stimuli, since faces were presented centrally on the computer screen with the whole head spanning only about 9.8 x 13° of VA. The nose, mouth and eye regions of course fall in the center of the face.

Importantly, compared to the aforementioned studies investigating the effects of various opioid agonist dosages on eye movement execution and accuracy, the current study employed a bidirectional drug manipulation, and we only interpret findings where the expected pattern of Morphine>Placebo>Naltrexone was present. It is therefore unlikely that the opposite side effects were observed with agonist and antagonist treatment. We are not aware of any studies reporting visuo-motor effects of naltrexone treatment. Nevertheless, to ensure that MOR-related changes in attention to the center of the face (eye and nose region) were not caused by drug side effects (i.e., passive fixation of participants' eye-gaze in the middle of the screen), we ran a control analysis assessing the number of fixations within the three main areas of interest.

Fixation number (Fix#) for each area of interest (AOI).

On average, participants showed higher fix# to the mouth-nose-jaw region followed by the eye region, and by the cheeks and forehead region. This pattern was found for both female (main effect of AOI, $F_{(2,5287)}$=1407.89, p<0.001) and male (main effect of AOI, $F_{(2,5272)}$=1488.06, p<0.001) faces. The nose and mouth region received the largest number of fixations for all three drug

conditions. Importantly, we found no evidence that the effects on fixation times of either of the drug manipulations reflected passive staring. In line with observed pattern of changes in the fix-t% data, morphine increased and naltrexone decreased the number of fixations to the eyes of female (AOI*Drug $F_{(4,5287)}$=18.47, p<0.001; M>N, t=6.80, p<0.001; M>P, t=2.33, p=0.02; P>N, t=4.47, p<0.001, Figure S1A) and male faces (AOI*Drug factors, $F_{(4,5272)}$=7.26, p<0.001; M>N, t=4.62, p<0.001; P>N, t=4.02, p<0.001, Figure S1B). Importantly however, while naltrexone decreased the number of fixations to the eye region, this drug manipulation increased the number of fixations to the nose, mouth and jaw region for both female and male faces. There was thus no evidence of non-specific drug side effects altering the pattern of visual attention to the faces.

Insert Figure S1 here

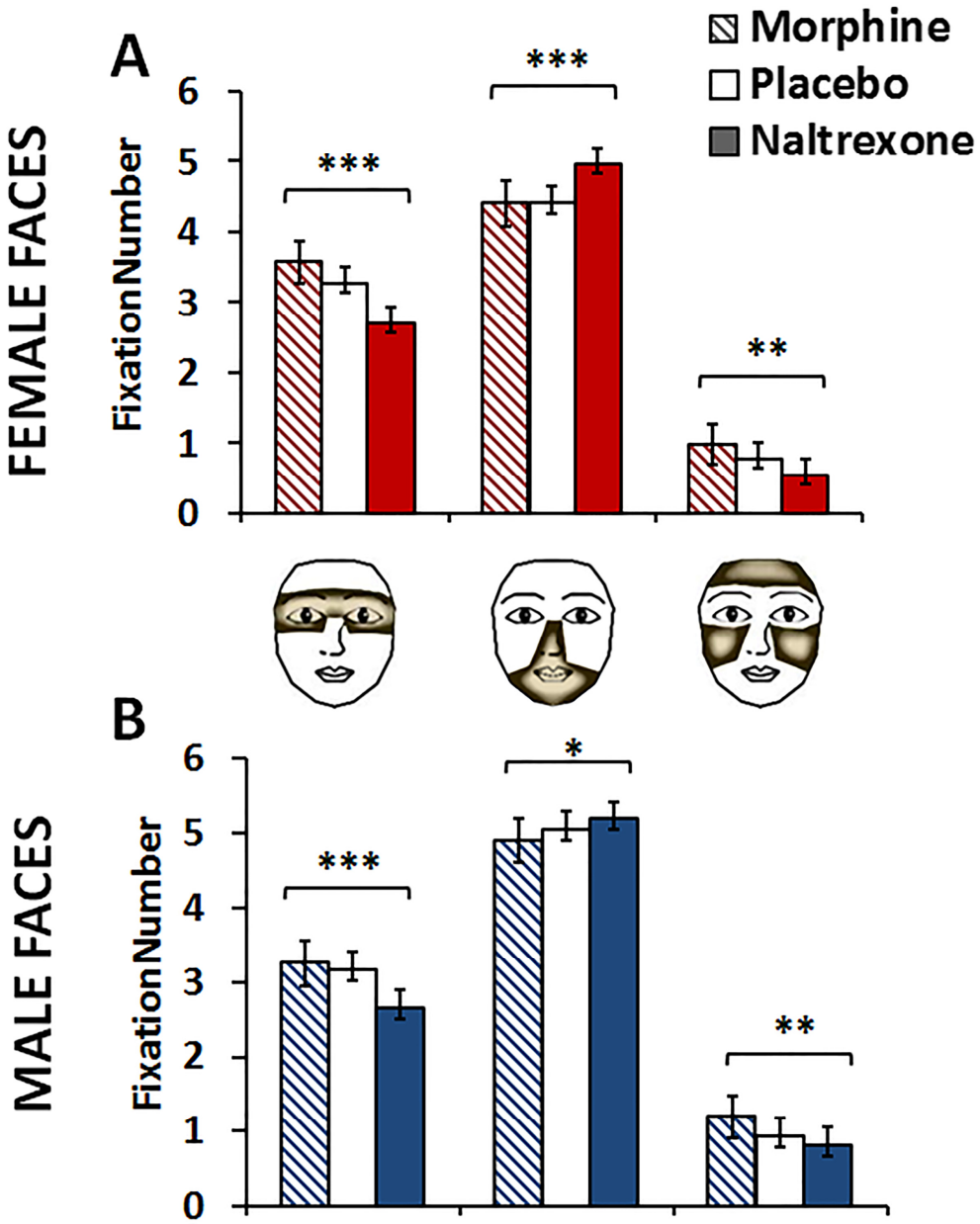

Figure S1 legend. Number of fixations to the selected AOIs of A) female and B) male faces as a function of MOR manipulation. Error bars represent within-subjects SEM. * indicates p < 0.001, ** indicates p < 0.01, * indicates p < 0.05. N=30.**

Table S1. Means and SDs for pre-drug baseline mood ratings, and for the change from baseline for the four mood types.

Mood Type	Drug	Pre-Drug Baseline	Change from Baseline
Happy	Morphine	6,26±1,66	-0,29±1,3
	Placebo	6,47±1,68	-0,23±1,07
	Naltrexone	6,19±1,47	-0,54±1,24
Anxious	Morphine	1,30±2,03	-0,42±1,55
	Placebo	0,79±1,60	-0,09±1,33
	Naltrexone	0,46±0,74	0,12±0,41
Irritated	Morphine	1,63±2,13	0,37±2,02
	Placebo	1,36±1,62	0,19±1,66
	Naltrexone	1,57±1,95	0,58±1,39
Feeling Good	Morphine	6,64±1,54	-0,64±1,52
	Placebo	6,79±1,71	-0,46±1,24
	Naltrexone	6,39±1,42	-0,51±1,36

SUPPLEMENTAL REFERENCES

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